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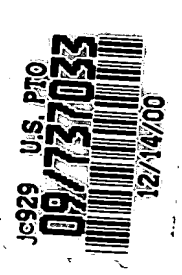

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For: CONTROLLING A TERMINAL OF A COMMUNICATION SYSTEM

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Patents ADP number *(if you know it)* 59119 95004

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CONTROLLING A TERMINAL OF A COMMUNICATION SYSTEM

FIELD OF THE INVENTION

The present invention relates to controlling of at least one function of a terminal of a communication system.

BACKGROUND OF THE INVENTION

In a communication system a terminal is used for providing a user interface for the user of the communication system. In other words, by means of the terminal the user may access and communicate over the communication system.

An example of the terminal is a mobile station that may be used in a radio communication system. The mobile station is typically a portable hand-held device that provides, in cooperation with the radio communication system, mobility for the user. When the mobile station is not in use, it is usually positioned in the user's pocket or in a special case or similar. The mobile station typically comprises a keypad for controlling the operation thereof, such as for dialing in a desired telephone number and for controlling various functions of the mobile station. A mobile station is also typically provided with a display. The display may be used for showing various information to the user of the mobile station. Instead of being an entirely hand-held unit, a mobile station may also comprise separate units, such as a base transceiver unit and a separate handset portion and/or a separate headset portion.

Another example is a user terminal for a fixed line communication system. Similarly to the mobile station, the fixed line user terminal, such as a conventional telephone apparatus, typically comprises keys or buttons for the control operations. In addition, a fixed line terminal typically comprises a "hook" that senses whether a separate handset portion and/or a headset portion is placed on the hook indicating that the terminal is not in use. Handheld fixed line terminals that are in the form of a single unit are also known.

The user typically controls the operation and/or functions of the terminal by pressing appropriate buttons on a keyboard of the terminal or by lifting the handset off-hook/placing the handset on-hook or opening/closing a specific cover connected to a switch and so on. Voice activated control systems are also known. For example, when the user wishes to establish a call, he usually selects or fetches the desired destination number by pressing appropriate keys on the keyboard or he may use possible voice activation functions of the terminal. When the user receives a call, the call is typically answered by lifting the handset off-hook, or by pressing at least one key of the keyboard or by opening the special cover of the keyboard. Similarly, any other functions of the terminal may be controlled by pressing appropriate keys or moving one or several components of the terminal to operate an associated switch. The functions and/or operations that need to be controlled may be functions such as switching the terminal between different modes of operation, controlling a keyboard lock or display of the terminal, switching on/off the lightning of the keyboard or the display, or controlling any other special features of the terminal or services provided for the user of the terminal (such

as voice mail, short text messages, calendar or alarm functions and so on).

For example, a mobile station may be provided with a keyboard lock referred to above. The basic idea of the keypad or keyboard lock is to prevent the user to mistakenly press any of the keys when this is not desired (e.g. when the mobile station is in the pocket of the user). For example, by means of the lock it is possible to prevent an accidental call establishment to a telephone number that is not actually selected. The keyboard lock may be controlled in alternative ways. According to one possibility predefined keys of the keypad can be used for locking and unlocking the keypad of the mobile station. According to an alternative the closing and opening of a special keypad cover will lock and unlock the keys accordingly.

Whenever the user wishes to control a function of the terminal, he needs to perform a predefined act. For example, when answering a call terminating at a mobile station, it is typically required that the user presses a predefined button or opens a cover of the keyboard or even both. The users may, however, feel the use of the present control arrangements uncomfortable/time consuming. They may also forget to use functions such as the keyboard lock. There are also occasions where automatic control between different modes of operation of the terminal might be desired.

SUMMARY OF THE INVENTION

It is an aim of the embodiments of the present invention to address one or several of the disadvantages of the prior art

terminals and to provide a new type of solution for controlling one or several functions of a terminal.

According to one aspect of the present invention, there is provided a terminal for a communication system, the terminal comprising detector means that are arranged to detect a contact between at least one surface of the terminal and the skin of the user of the terminal, wherein at least one function of the terminal is controlled based on a signal from the detecting means.

The detector means may comprise a first detector arrangement and a second detector arrangement, wherein said first and second detector arrangements are based on different principles of detecting a contact between the terminal and the skin of the user. The control of the terminal that is based on the signal from the detector means is preferably provided only if said first and second detector arrangements both output a signal that indicates a contact between the terminal and the skin of the user.

According to one aspect of the present invention, there is provided a detector arrangement for a terminal of a communication system, the terminal comprising at least one element that is to be held against the skin of the user of the terminal, the detector arrangement comprising circuitry for generating an output signal whenever a surface of the terminal touches in a predefined manner the skin of the user, wherein the output signal is arranged to be employed in the control of at least one function of the terminal.

According to another aspect of the present invention, there is provided a method for providing control of at least one function of a terminal of a communication system, comprising the steps of:

detecting a contact between a surface of the terminal and the skin of the user of the terminal;

generating an output signal indicating a contact between the surface of the terminal and the skin of the user; and

controlling said at least one function of the terminal based on the output signal.

The embodiments of the invention may provide an automated and reliable control of at least one function, such as the keyboard lock and/or switching between different modes of operation of the terminal (e.g. standby and activated) and/or special service or feature. The embodiments may make the use of the terminal more convenient. The embodiments may prevent any unwanted activation of one or several of the functions of the terminal while the terminal is not in use.

BRIEF DESCRIPTION OF DRAWINGS

For better understanding of the present invention, reference will now be made by way of example to the accompanying drawings in which:

Figure 1 shows one embodiment of the present invention;

Figure 2 is a schematic illustration of galvanic touch sensor circuitry;

Figure 3 shows a possible pattern of sensors arranged in accordance with one embodiment of the present invention;

Figure 4 is a schematic illustration of capacitive proximity sensor circuitry;

Figure 5 shows a block chart of an automated keyboard lock arrangement; and

Figure 6 is a flowchart of the operation in accordance with one embodiment of the present invention.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Figure 1 shows a mobile station in accordance with an embodiment of the present invention. The mobile station 1 comprises a housing or cover portion 11 which protects and encapsulates the various internal components of the mobile station. The internal components are not shown in greater detail, but may typically comprise components such as a processor 12 that is for controlling one or several functions of the mobile station. The mobile station 1 also comprises transceiver means (not shown) for receiving and transmitting a radio signal through an antenna 2, possible circuit boards, lightning components and other internal components known in the art. The cover or housing 11 is usually of plastic material, but other materials may also be used.

The terminal 1 comprises further a keypad 3. The keypad typically comprises several buttons such as "on-hook" and "off-hook" keys (sometimes referred to as "yes" and "no" keys) and keys for numerals from zero to nine. The keys can also be used for typing in alphabetic characters, such as for typing in short text messages and inputting names and numbers into a telephone number memory and/or entries into diaries or other special

functions provided by the mobile terminal. The mobile station 1 may also comprise a separate power switch 9.

The mobile station 1 comprises also a display 4. The display may be used for displaying various messages and information to the user. The user may also use the display for the control operations of the mobile station, e.g. such that the uses the keys 3 for the selection of an appropriate function from a menu displayed to him by the display 4. The mobile station 1 may also be provided with a loudspeaker 5 and a microphone 6. A battery 10 is detachably attached onto the back side of the mobile station 1.

Two strip electrodes 7 and 8 are attached on one side of the station 1. The electrodes 7 and 8 are employed for detecting a contact between the skin of the user and the mobile station. According to a possibility the electrodes 7 and 8 are attached on the outer surface of the housing 11 of the mobile station 1. The electrodes may also be embedded in the cover material such that the surface of the electrodes will remain visible and may thus be touched by the skin of the user.

More particularly, the electrodes 7 and 8 may be arranged to measure so called galvanic skin response (GSR). Figure 2 discloses a block diagram for circuitry that may be used when implementing a galvanic skin response touch sensing arrangement 20. The first electrode 7 is coupled to a voltage source Vcc via a line 27. The voltage Vcc may equal the operational voltage of the mobile station, but Vcc may also be different from that. Voltage Vcc is preferably provided by the battery 10 of the mobile station 1. A buffer 21 and an appropriate impedance 24

may be provided for scaling the current and voltage on the line 27 between the electrode 7 and the voltage source Vcc. The second electrode 8 is coupled to an output 26 of the circuitry 20. The signal from the electrode 8 may be amplified by an amplifier 23 before the signal is output from the circuitry 20. The amplifier circuit may comprise a resistor/impedance 25.

The galvanic skin response (GRS) detection method is based on provision of a conductive path between two or more electrodes. When the user grips the mobile station 1 by his hand (not shown), the skin of the hand will provide the conductive path between the electrodes 7 and 8 of Figures 1 and 2. Now, when a conductive path is provided between the electrodes 7 and 8, the voltage and current at the output line 26 will change in accordance with known principles. The GSR sensing arrangement 20 gives typically so-called TTL level (transistor to transistor logic level) output signal when the conductive material is in touch with at last two of the electrodes. A component 22 may be used for setting an appropriate threshold level for the conductivity, i.e. the component 22 may trigger the circuitry 20 to output a signal that indicates a contact between the hand of the user and the mobile station 1.

As illustrated by the flow chart of figure 6, the output signal on line 26 may be used in the control of a function of the mobile station. For example, activation of a mobile station that is in a standby mode may be based on the output signal from the sensing arrangement. The activation of the mobile station may be triggered by the control unit 12 of the mobile station based on a received TTL level signal output 26 from the GSR arrangement 20. The station may be correspondingly deactivated i.e. returned

to the standby mode after the control unit no longer receives the TTL level signal. An automated keyboard lock may function in a corresponding manner, i.e. the keyboard may be unlocked only when the GSR detecting arrangement outputs a TTL level signal. The station may also be switched between different modes of operation or even on and off based on the output signal received from the detecting means. The lighting of the keypad and/or the display may be controlled based on this information. According to an example, a vibrating alarm arrangement of the mobile station is controlled such that no sound alarm is provided when the mobile station is detected to be in contact with the skin of the user, while a sound alarm will be provided when the mobile station (or any part or accessory thereof) is not in direct contact with the skin of the user. It is to be noted that the above functions described in the context of a mobile station are only examples and that the embodiments of the present invention may be employed when controlling any function of a communications terminal. It is also noted that the output signal from the detector arrangement may indicate a "positive" or "negative" contact. In other words, a signal may be outputted only when the terminal is in contact with the skin of the user or alternatively only when there is no contact between the user and the terminal.

The electrodes or sensors can be arranged in many alternative ways on the surface of the mobile station 1. For example, one of the electrodes could be positioned on one side surface of the station like the electrode 7 (or 8) of Figure 1 while another electrode could be placed on the opposite side surface of the mobile station or on the back or front surface of the mobile station

It may be difficult in some instances to measure the GSR response by only two electrodes, for example because different users tend to hold the mobile station in different ways. Therefore it may be advantageous to provide the terminal with more than two electrodes. The electrodes may also be positioned in an appropriate array. Figure 3 shows one possibility for such an array, even though there are various different alternatives for this. The array of the electrodes could be placed, for example, on the back surface of the mobile station.

According to an alternative the mobile station or some parts thereof is covered with an electrically conductive material, such as a metallic coating, and an appropriate isolation is provided between the various parts of the cover. The material of the housing 11 itself may be made from a conductive material. Thus the housing 11 of the mobile station 1 may also be used as a sensing electrode.

Another possibility for measuring the presence of the living tissue in touch or in close proximity with the terminal is so-called capacitive proximity (CP) sensor. The capacitive proximity sensor requires only one electrode, even though it is possible to use several CP sensors. The CP based system can be adjusted to sense the proximity of the living tissue, for example such that a CP sensing arrangement will react when the distance between the skin of the user and the mobile station is within a range of 0 to 5 mm. The capacitive proximity sensors may be arranged to be sensitive only for living tissue, and will thus not react to other materials. When the capacitive proximity sensor senses a living tissue, it may output an appropriate

signal, such as a TTL level signal. The use of the TTL level output signal in accordance with the invention was already discussed above.

Figure 4 shows a schematic block diagram for a detection circuitry 31 based on the capacitive proximity sensor detection. In general, the circuitry 31 can be defined as oscillating circuitry that is implemented by means of a flip-flop switch 32. The circuitry 31 is provided with suitable triggering means 33, such as a Schmitt trigger. An inverting amplifier 34 may also be provided on the output line 35. The circuitry operates such that when the capacitive sensor 30 is touched by a living tissue, the output on line 35 will rise in the Vcc level, thus providing a signal indicating that the terminal is in touch with living tissue.

The capacitive proximity sensor may also detect a living tissue, such as the skin of the user, that is not in an direct contact with the sensors. The skin may be, for example, within a distance that is up to 5 mm from the sensing electrode. Therefore the capacitive proximity electrode 30 may be placed on the internal surface of the cover material of the terminal 1 or may be embedded within the cover material of the terminal 1. For example, it could be placed inside the cover of the battery 10 of the mobile terminal 1.

In addition to the above described two techniques for sensing the presence of human skin, it is possible to use other sensing techniques for providing an output signal indicating whether the terminal or a part thereof is in contact with a part of human body. For example, one or several pressure sensors may be

employed. Instead of just sensing any pressure subjected to the terminal, the pressure sensing arrangement may also be adapted to detect a predefined pressure pattern caused by a human hand. The pressure sensor may be, for example, a piezoelectric film or made from an elastoresistive material and so on. According to one alternative the terminal may be provided with means for sensing a change in the temperature of the cover material. That is, to sense a change in temperature that is caused by the hand of the user. The sensing arrangement may also detect a predefined temperature pattern on the surface of the terminal. As in the pressure detection, the shape of the hand and/or the fingers will cause a specific pattern that is detectable by appropriate sensing means. Suitable temperature sensor and sensor arrays are known, and will thus not be explained in more detail. Preferred temperature sensors comprise sensors arranged to detect fast predetermined changes in temperature.

The above discussed methods for detecting a contact with or a close proximity of the human skin is believed to work properly in various applications. However, the inventors have also found that there may also be applications where a more reliable detection is required. More precisely, the galvanic skin response (GSR) method may give an output signal when there is some other conductive material than the human skin in touch with the electrodes. The conductive material could be water, dust, a conductive textile, a conductive surface (such as the surface of a table) and so on. Therefore there may be, in some circumstances, a possibility to get an incorrect output signal from the detector means 20 of Figure 2. The close proximity (CP) method may also give false signals, for example when there is a very thin textile between the electrode and the human skin.

Therefore a verification of the detection result of a detection arrangement may be desirable in some applications. The verification can be provided by employing more than one sensing technique in the generation of the output signal to make sure that the terminal is indeed in the hand of the user or against the cheek or ear of the user.

Figure 5 shows an embodiment in which the output signals of the above discussed two different sensing techniques are combined prior a signal is inputted into the controller of the terminal. In brief, the arrangement of Figure 5 is such that an output signal 41 is provided by a combiner 40 only when both the galvanic skin response circuitry 20 and the capacitive proximity circuitry 31 provide a positive TTL level output signal to the combiner 40. By employing both the galvanic skin response and the capacitive proximity method in the same terminal it is possible to decrease the risk for incorrect signals and thus improve the reliability of the detection arrangement.

According to an embodiment the galvanic skin response sensor is arranged also to detect pressure. This is enabled by the realization that the electric conductivity will increase when the user takes a harder grip of the handset, i.e. presses the handset harder within his hand.

According to an alternative the pressure sensing by any appropriate pressure sensing means is used for giving instructions to the terminal, such as for confirming a selection suggested by the terminal. For example, when the user has to confirm that he wishes to proceed with a suggestion displayed to him by the display he may just grip harder on the terminal and

the controller of the terminal will subsequently perform the suggested operation. A further example relates to such short text message implementations where a mobile station may suggest a word. In this application the user may confirm the use of the suggested word simply by pressing the phone harder. In other words, the sensing arrangement of the invention may also be used for giving feedback and instructions to the communications terminal.

According to an embodiment the sensitivity of the sensing means is adjustable. This may be implemented, for example, by providing the circuitry 20 of Figure 2 with an adjustable threshold level component 22. In addition, the sensitivity of the control unit of the mobile station can be adjusted in accordance with specific requirements and/or conditions and may vary if the requirements and/or conditions change. According to an embodiment other information may also be employed when providing the control of a function of the terminal. For example, it may be desired to be able to adjust the sensitivity in accordance with the changed temperature conditions, as a cold hand is less conductive than a warm (and thus sweaty) hand. The controller may provide different instructions for the controlled functions depending the location or the context where the control is provided. For example, during a normal speech call the lighting of the display and/or keyboard may be switched off after a predefined time has lapsed from the activation thereof. However, the lightning will stay on if the connection was established for data communication, such as for a wireless application protocol (WAP) connection or for an Internet connection. The sensing arrangement may also be adapted such that it will take changes in the time of the day and/or seasons

of the year or changes in the conductivity of the components used for the sensors into account. The adjustment may also be adaptive so that the controller may itself adjust the operation thereof to be within certain predefined parameters. This may be implemented by means of statistical analysis that are made for a predefined data over time.

It should be appreciated that whilst embodiments of the present invention have been described above in relation to mobile stations, embodiments of the present invention are applicable to any other suitable type of communication user equipment, such as fixed land line terminals and any parts or accessories of the terminals. The accessories include devices such as earpieces, headsets, handsets and keyboards that are operationally connected to the terminal.

It is also noted herein that while the above describes one exemplifying embodiment of the invention, there are several variations and modifications which may be made to disclosed solution without departing from the scope of the present invention as defined in the appended claims.

Claims

1. A terminal for a communication system, the terminal comprising detector means that are arranged to detect a contact between at least one surface of the terminal and the skin of the user of the terminal, wherein at least one function of the terminal is controlled based on a signal from the detecting means.

2. A terminal according to claim 1, wherein the detector means comprise a first detector arrangement and a second detector arrangement, wherein said first and second detector arrangements are based on different principles of detecting a contact between the terminal and the skin of the user.

3. A terminal according to claim 2, wherein the control based on the signal from the detector means is provided only if said first and second detector arrangements both output a signal that indicates a contact between the terminal and the skin of the user.

4. A terminal according to any of the preceding claims comprising a controller for controlling said at least one function of the terminal.

5. A terminal according to any of the preceding claims, wherein switching between different modes of operation of the terminal is arranged to be triggered based on the signal from the detector means.

6. A terminal according to claim 5, wherein the terminal is switched between a standby mode and an active mode.

7. A terminal according to any of the preceding claims, wherein a keypad lock of the terminal is operated based on the signal from the detector means.

8. A terminal according to any of the preceding claims, wherein the operation of a display of the terminal is controlled based on the signal from the detector means.

9. A terminal according to any of the preceding claims, wherein the operation of an alarm producing means is controlled based on the signal from the detector means.

10. A terminal according to any of the preceding claims, wherein the detector means are arranged to sense a contact between the terminal and the hand of the user.

11. A terminal according to any of the preceding claims, wherein the detector means are arranged to sense a contact between the terminal and the cheek and/or ear of the user.

12. A terminal according to any of the preceding claims, wherein the detector means comprise a galvanic skin response detection arrangement.

13. A terminal according to any of the preceding claims, wherein the detector means are arranged to detect a pressure caused by the hand of the user.

14. A terminal according to claims 12 and 13, wherein the galvanic skin response detection arrangement is adapted to detect a gripping pressure caused by the hand of the user of the terminal.

15. A terminal according to claim 13 or 14, wherein a predefined pressure pattern is arranged to be detected.

16. A terminal according to any of the preceding claims, wherein the detector means comprise a capacitive proximity sensor.

17. A terminal according to claim 16, wherein the capacitive proximity sensor is placed on the inner surface of a cover of the terminal or an accessory thereof.

18. A terminal according to any of the preceding claims, wherein at least a part of the detector means is provided in a detachable part of the terminal.

19. A terminal according to any of the preceding claims, wherein the detecting means are integrated in the cover material of the terminal.

20. A terminal according to any of the preceding claims, wherein the detector means comprise at least three sensor elements, said at least three sensor elements being arranged in an array on the surface of the terminal.

21. A terminal according to any of the preceding claims, wherein the control is based on adaptive use of the information provided by the signal from the detector means.

22. A terminal according to any of the preceding claims, wherein the sensitivity of the detector means is adjustable.

23. A terminal according to any of the claims 4 to 22, wherein the controller is adjustable so that the controller provides different control instructions for the function controlled by the controller depending on the settings of the controller.

24. A terminal according to any of the preceding claims, wherein the control of the function is based, in addition to the signal from the detector means, on at least one of the following: the operational status of the terminal; the location of the terminal; the time of the day; the time of the year; temperature; the type of the communication.

25. A terminal according to any of the preceding claims, wherein the detector means are provided in a handset or headset of the terminal.

26. A terminal according to any of the preceding claims, wherein the terminal comprises a mobile station of a radio communication system.

27. A detector arrangement for a terminal of a communication system, the terminal comprising at least one element that is to be held against the skin of the user of the terminal, the detector arrangement comprising circuitry for generating an

output signal whenever a surface of the terminal touches in a predefined manner the skin of the user, wherein the output signal is arranged to be employed in the control of at least one function of the terminal.

28. A detector arrangement in accordance with claim 27, comprising a first detector arrangement and a second detector arrangement, wherein said first and second detector arrangements are based on different principles of detecting a contact between the terminal and the skin of the user.

29. A detector arrangement according to claim 28, wherein the detector arrangement provides the output signal only if said first and second detector arrangements both output a signal that indicates a contact between the terminal and the skin of the user.

30. A method for providing control of at least one function of a terminal of a communication system, comprising the steps of:

detecting a contact between a surface of the terminal and the skin of the user of the terminal;

generating an output signal indicating a contact between the surface of the terminal and the skin of the user; and

controlling said at least one function of the terminal based on the output signal.

31. A method according to claim 30, wherein the generation of the output signal comprises further steps of:

receiving a first signal from a first detector arrangement;

receiving a second signal from a second detector arrangement that is different from the operation principles thereof from the first detector arrangement;

verifying the first and second signals; and

generating the output signal if said first and second signals indicate similar results of detection.

Abstract

The present invention relates to a terminal for a communication system. The terminal comprises detector means that are arranged to detect a contact between at least one surface of the terminal and the skin of the user of the terminal. At least one function of the terminal is arranged to be controlled based on a signal generated by the detecting means in response to the detection. The invention relates further to a detector arrangement for a communications terminal and a method for controlling a communications terminal.

(Fig. 1)

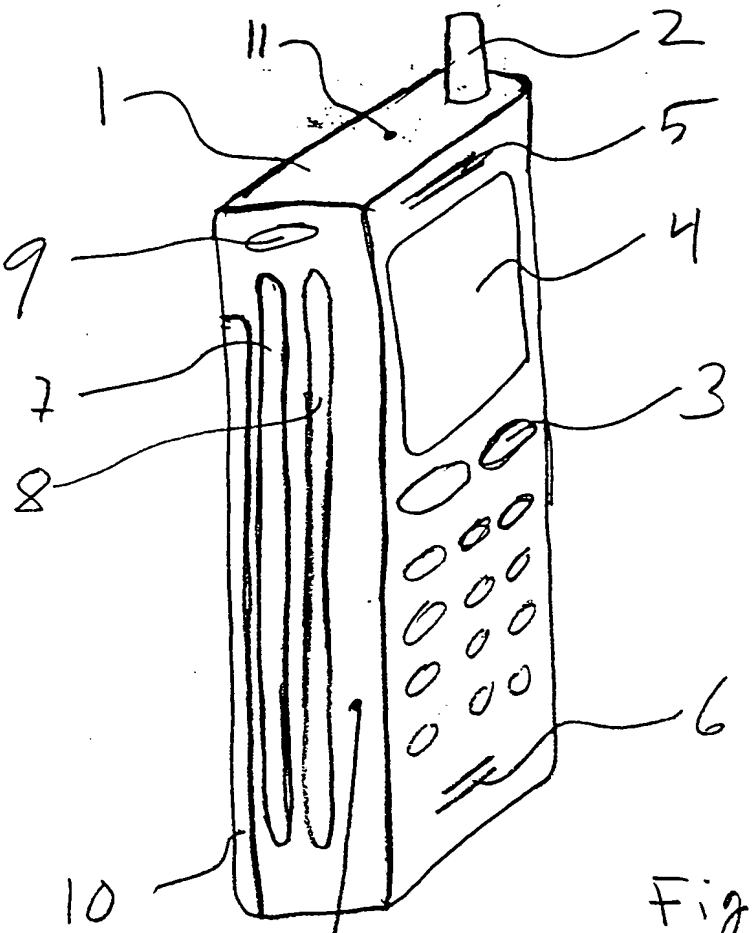
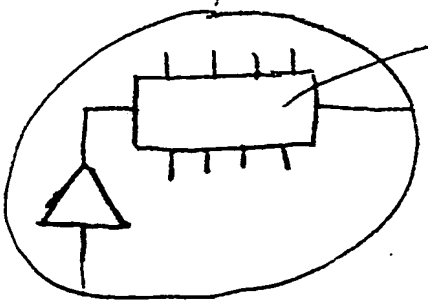


Fig. 1



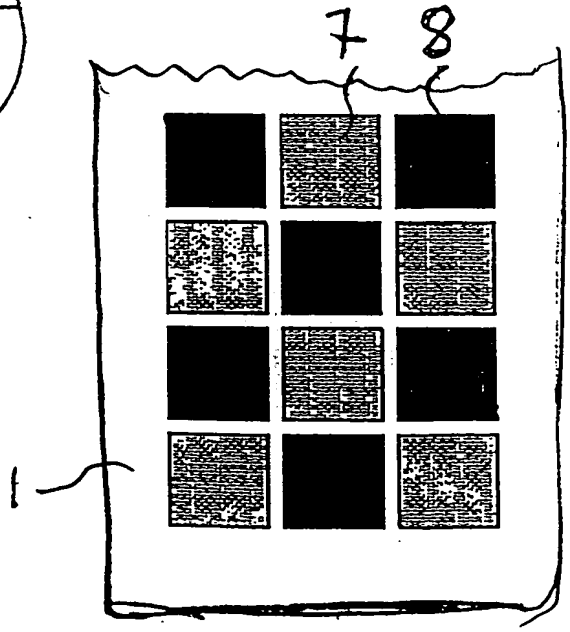


Fig. 3

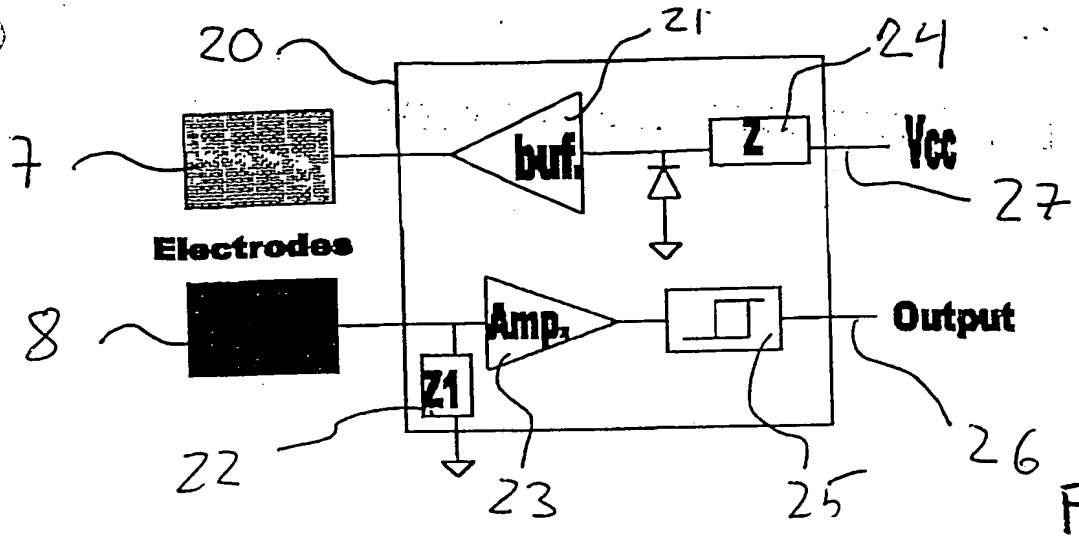

20
21
24
7
buf.
Z
Vcc
27
Electrodes
8
Amp.
Output
Z1
22
23
25
26

Fig. 2

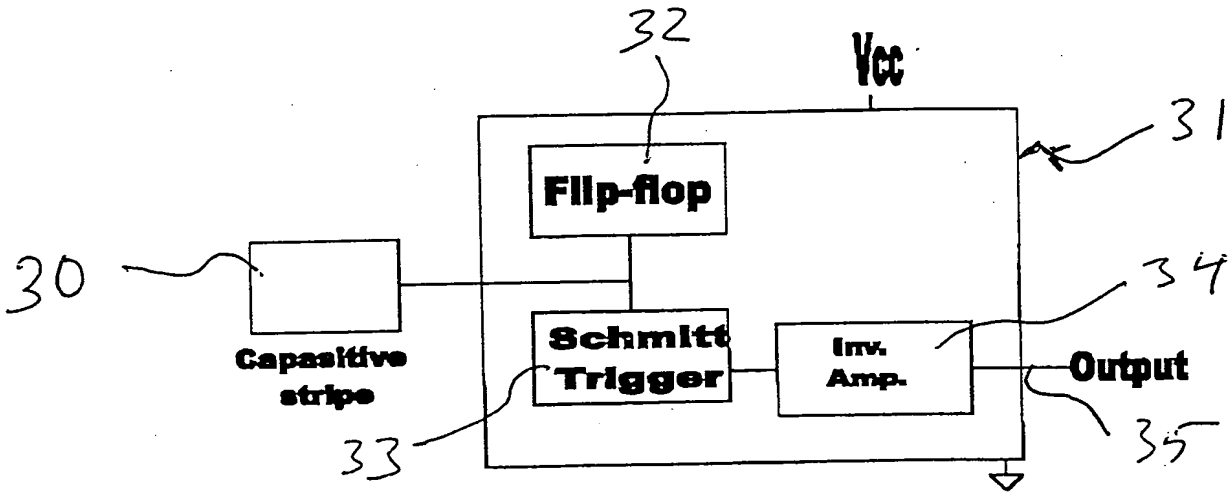

32
Vcc
31
Flip-flop
30
34
Schmitt Trigger
Inv. Amp.
Output
Capacitive stripe
33
35

Fig. 4

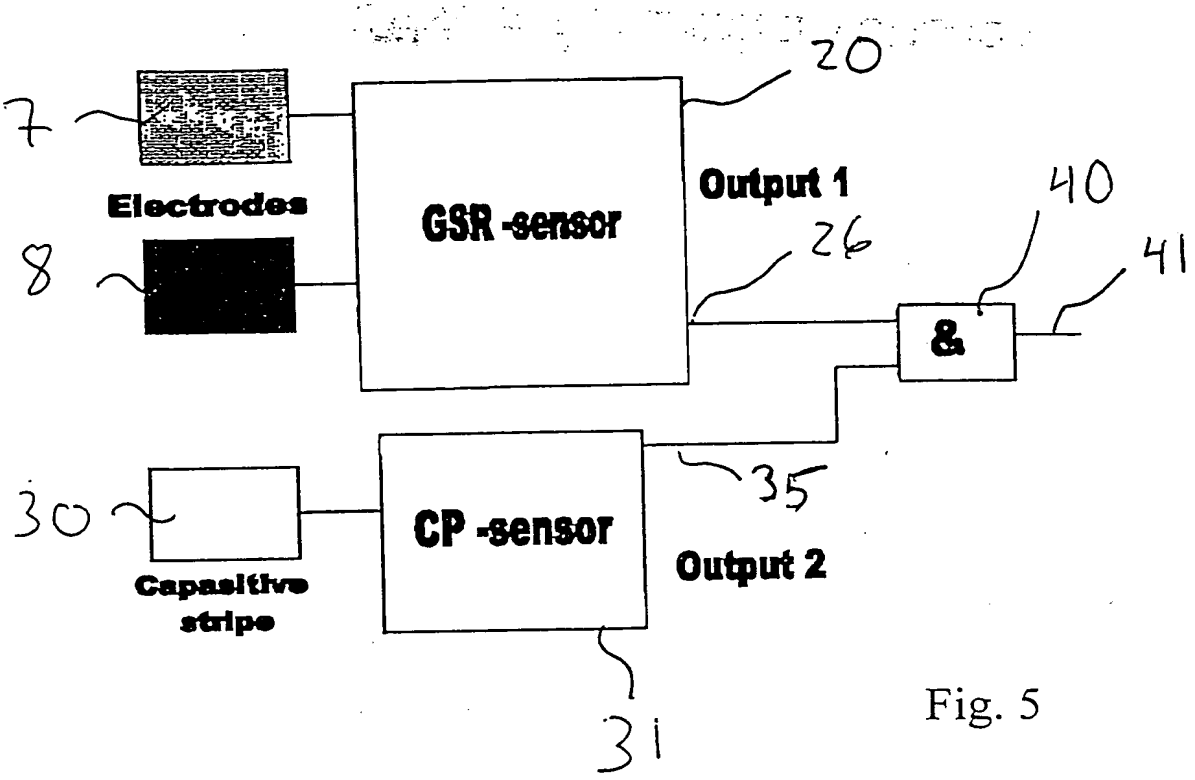

7
Electrodes
8
GSR -sensor
20
Output 1
26
40
41
&
30
Capasitive stripe
CP -sensor
35
Output 2
31

Fig. 5

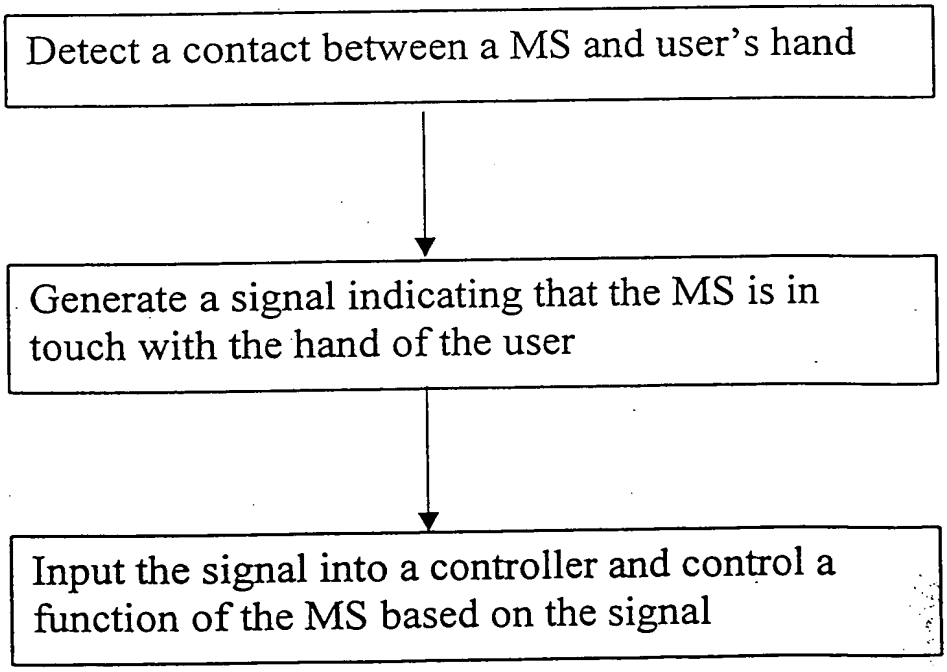

Detect a contact between a MS and user's hand
Generate a signal indicating that the MS is in touch with the hand of the user
Input the signal into a controller and control a function of the MS based on the signal

Fig. 6